REMARKS

Claims 1 to 18 are rejected. Claims 19 to 21 are withdrawn from consideration.

Section 112 Rejection:

Claim 15 was rejected as having inconsistent language as to whether the claim was drawn to a "force resisting device" alone, or a combination of a "force resisting device" and a "sill plate".

Claim 15 has been amended to clarify that it is indeed drawn to a "force resisting device" alone.

Section 102 and 103 Rejections:

Claims 1-3, 7-14 and 16-18 were rejected as anticipated by Mueller.

Claims 4-6 and 15 were rejected as obvious over Mueller.

(a) The Presently Claimed Invention:

Independent claims 1, 8, 11 and 16 each set forth:

"A force-resisting device for ..... **dissipating and absorbing** energy across a discontinuous structural element...." [emphasis added].

It is important to note that "dissipating" energy and "absorbing" energy are not the same thing. Specifically, as defined in the specification, "dissipation" is a "**permanent and irreversible**" energy change. [p. 16, line 18 of the specification]. In contrast, "absorption" is a "**temporary and reversible**" energy change. [p. 17, line 2 of the specification].

Plastic deformation is an example of permanent/irreversible energy **dissipation**. [p.16, line 20]. Specifically, plastic deformation dissipates energy by heat (e.g.: when permanently bending a structural member).

Elastic deflection is an example of temporary /reversible energy **absorption**. [p. 17, line 4]. As such, elastic deflection simply absorbs energy such that it can be released later. (For example, when flexing a structural member such that it can later spring back into shape).

In summary, the presently claimed invention provides a system specifically configured to **both**: (a) plastically deform for permanent/irreversible energy dissipation; and (b) elastically deflect for temporary /reversible energy absorption.

This is especially beneficial in earthquake reinforcement. Specifically, the present invention can be used to accommodate normal day-to-day building loads (by deflecting within its normal elastic range), while also accommodating larger earthquake loads (by deforming within its normal plastic range) so as to prevent building collapse. In particular, the present invention is plastically deformable within a normal range of operation so as to avoid catastrophic failure of the structure to which it is attached.

Thus, the present invention provides a dual-use structure that absorbs normal building loads in its elastic state, but also dissipates larger earthquake loads by controlled plastic deformation (i.e.: without transmitting the full earthquake load from one structural member to another).

Secondly, independent claims 1, 8, 11 and 16 also each set forth:

"....[an] **active element** having **defined force versus deflection properties**, ..." [emphasis added]

As defined in the specification, the present "active element" is a device configured to both "**deflect *or* distort** in a **controlled manner** under load." [p. 17, lines 15 to 17].

Thus, the presently claimed active element is specifically configured such that it will both:

(a) deflect – i.e.: elastically absorb energy in a *controlled* manner; and also

(d) distort – i.e.: plastically dissipate energy in a *controlled* manner.

Thirdly, independent claims 8 and 16 further set forth:

".... the active element [and] the frame element ... are configured to ... reduce stresses and **replace stiffness, dissipation, and strength** to the structure. [emphasis added].

An example of this feature is seen in Fig. 4B where force resisting device (100) is positioned around an opening (e.g.: a window or door in a wall). In a preferred embodiment, force resisting device (100) includes a series of bendable folds (Fig. 5) that deflect or deform accordingly so as to "replace stiffness, dissipation, and strength to the structure".

By "**replacing**" the stiffness, dissipation, and strength to the structure as claimed, the present system uses **both an active element and a frame element** to restore structural strength. For example, the present active and frame elements may be used together to restore the strength to a shear wall that is lost by the presence of an opening in the wall. In other words, after installation of the present invention around the opening in the wall, the wall performs "as if no opening existed in the shear wall". (p. 23, line 5 of the specification).

Test results of the present invention are seen in the graph in Fig. 10, illustrating the performance of shear wall (200 in Figs. 6 and 7), as follows. Line 400 illustrates the load vs. deflection properties of the solid wall (Fig 6). Line 500 illustrates the load vs. deflection properties of the wall with an opening therein (Fig. 7). As can be seen, the structure is considerably weakened. (IE: line 500 is far below line 400). Line 600 then illustrates the

load vs. deflection properties of the wall with an opening therein, **but with a force-resisting device (100) positioned around the opening** in the wall (Fig.9). As seen in Figs. 4A and 4B, the force-resisting device (100) **includes both an active element (130) and a frame element (120).** As can also be seen by viewing line 600, the present invention restores/replaces the strength to the system. (IE: line 600 is back up near line 400).

(b) The Mueller System:

Mueller sets forth a bracket for connecting a vertical post (110) to an anchor bolt (130) extending upwardly from a building foundation (120). As seen in its Fig. 6, the flat bottom end of bracket (100) slips under the bottom end of post (110). Bracket (100) is connected to anchor bolt (130) that protrudes upwardly through the foundation (120) by a hold down bolt (170). Specifically, the top end of upwardly extending anchor bolt (130) and the bottom end of downwardly extending hold down bolt (170) are held together by a coupling nut (182). (Further details of this connection are shown in Fig. 5.) Returning to Fig. 6, an optional spring (172) can be provided to resist upward movement of the vertical post (110). When post (110) is lifted vertically, spring (172) is compressed.

(c) The Mueller System Distinguished:

Part I: Controlled Elastic and Plastic Behavior Within The System's Normal Range of Operation (Claims 1, 8, 11 and 16):

As stated above, the presently claimed invention provides a system that both:

(a) elastically deflects to absorb energy in a controlled manner; and

(b) plastically deforms to dissipate energy in a controlled manner.

In contrast, Mueller simply provides a system of attaching a vertical post to a building foundation wherein spring (172) resists vertical upward movement of post (110).

Mueller is therefore only configured to absorb energy by controlled elastic deflection. IE: spring (172) is compressed when vertical post (110) is lifted relative to foundation (120).

However, Mueller is NOT configured to dissipate energy by deforming plastically in a **controlled** manner, as defined by the present claims.

In setting forth the present rejections, the Examiner admitted that Mueller "does not specifically disclose elastic and plastic behaviors under varying stresses". However, the Examiner contends that the Mueller system would "inherently behave in a similar manner". [P.4 of the Office Action].

Thus, the Examiner's contends that Mueller could deform plastically.

The Applicants admit that any structure will eventually deform plastically if the stresses on it are high enough. Put another way, any device or structure will eventually either be crushed in compression, or torn apart in tension if the stresses on it are high enough. However, such catastrophic failure of a device under excessive loading is not "controlled" deformation, as defined by the present invention.

Instead, the present active element (as defined in the specification) is specifically configured for **controlled** plastic deformation within its normal range of operation. In contrast, Mueller is not at all configured for controlled plastic deformation within its normal range of operation. Instead, any plastic deformation of the Mueller system would only be in failure (e.g.: after spring 172 has been fully compressed – with post 110 then being torn off of foundation 120).

For the above reasons, the Applicant's submit that independent claims 1, 8, 11 and 16 (and all claims depending therefrom) are allowable. Withdrawal of the present anticipation and obviousness rejections to these claims is respectfully requested.

Part II: Replacement of Lost Stiffness (Claims 8 and 16):

Independent claims 8 and 16 set forth an active element **and** a frame element that together **replaces stiffness, dissipation, and strength** to a structure. For example, a system that **restores** the strength to a structure that is **lost** by the presence of an opening therethrough.

To replace stiffness, dissipation and strength to a structure it is necessary to compensate for the shear forces applied to the structure. Any shear force will have both **vertical** and **horizontal** components. Therefore, to replace stiffness, dissipation and strength to a structure, it is necessary to compensate for both vertical and horizontal forces to the structure and also to the overturning (i.e.: rotational) moments that these forces create in the structure.

The present invention is specifically designed to resist such multiple forces and moments in different directions in a controlled manner. This is accomplished by use of **separate** active and frame elements which **together** compensate for vertical and horizontal forces (and their overturning moments). Accordingly, the structure's stiffness is **replaced** (i.e.: **"put back"** into the structure).

For example, the present active and frame elements can be used together to transmit shear around an opening in a wall so as to restore the force-resisting properties of the wall. This is shown by the Applicants' test data, wherein the system illustrated in Fig. 4B is used to achieve the stresses shown in Fig. 9 around the opening in the wall. In the absence of the

system of Fig. 4B, the much larger stresses (as shown in Fig. 7) are instead exerted on the shear wall around the opening in the wall. Thus, attaching the system of Fig. 4B to the shear wall **replaces** the stiffness, dissipation and strength to the wall that is lost by the opening in the wall.

In contrast, Mueller is merely a "hold down" connector that simply holds a vertical post down onto a building foundation, as follows. Mueller's spring system is only activated by relative movement between post (100) and foundation (120). Specifically, Mueller's system is only activated when post (110) is pulled vertically away from foundation (120), so that spring (172) is compressed. Thus, Mueller only resists forces in one (i.e.: vertical) direction. Mueller is **not** able to compensate for both vertical and **horizontal** forces. Therefore, Mueller is not able to compensate for overturning (i.e.: rotational) moments in the structure, as would be required to **replace stiffness, dissipation, and strength** to the structure, as claimed.

Specifically, Mueller only reacts **vertical** forces **into the foundation**, whereas the present invention replaces stiffness and strength **to the structure itself.**

Therefore, in contrast to the present invention, there is no load path or mechanism in Mueller such that **multiple forces** and **moments** can be resolved **within the structure itself.**

Moreover, for Mueller to operate, the building structure to which it is attached must be **stiffer** than the spring. In contrast, the present active and frame elements together provide support to a **less stiff** building structure. Thus, the presently claimed invention provides support to a "weaker" attached structure, whereas the Mueller spring provides resistance to a "stronger" attached structure.

For the above reasons, the Applicant's submit that independent claims 8 and 16 (and all claims depending therefrom) are allowable. Withdrawal of the present anticipation and obviousness rejections to these claims is respectfully requested.

Conclusion:

For the reasons presented above, all claims are believed to be in condition for allowance. A Notice of Allowance is therefore respectfully requested.

Should the Examiner feel that a telephone conference would advance prosecution of the present application, he is invited to call the undersigned attorney at the number listed below.

Respectfully submitted,

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